COTMAN IN COTTON RESEARCH

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INTRODUCTION

The cotton information management system, COTMAN, has become an important crop monitoring tool for many Arkansas cotton producers and their consultants. The COTMAN system also has utility in cotton research programs. Crop monitoring information obtained using COTMAN provides a detailed record of crop status recorded and summarized in a standardized manner from observations made in each experimental plot. In addition to the benefits of excellent record keeping, COTMAN summaries allow for improved communication between cotton professionals from different production areas and across disciplines.

A discussion of labor and time requirements for using COTMAN in small plot research is presented. In addition, examples of different COTMAN growth curves derived from cotton research work in Arkansas and West Texas are provided to demonstrate the utility of COTMAN in communicating crop growth patterns observed in research projects.

BACKGROUND INFORMATION

COTMAN growth curves provide important information about the pace of crop development. They are developed from field data collected using a simple monitoring procedure in which plant mappers count squaring nodes (Danforth and O'Leary, 1998). Squaring nodes are fruiting branches that have not yet produced flowers. Before flowering, the number of squaring nodes equals the number of sympodia; after flowering, squaring nodes are simply the number of sympodia above the first position white flower [nodes above white flower (NAWF)]. Data are recorded either by hand or using a data logger and then are uploaded to a desktop PC for analysis. In the COTMAN analysis, the number of squaring nodes produced over time are plotted to produce a COTMAN growth curve; these data are compared to the target development curve (Fig. 1). Under good conditions, there should be steady increase in number of squaring nodes until first flower. Then good stress from plant structure and boll loading becomes the dominant force resulting in an abrupt downturn in rate of production of squaring nodes. Subtle changes in environmental conditions can change the shape of growth curves, and inter-

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pretation of plant response to these conditions is possible (Bourland *et al.*, 1999).

Crop monitoring with COTMAN enables the user to identify the flowering date of the last effective boll population, i.e., that last population of bolls that significantly contributes to yield. On the flowering date of the last effective boll population, the crop has reached cutout (Oosterhuis *et al.*, 1998). Under good growing conditions with adequate fruit retention and boll filling, cutout will occur at when the mean number of nodes above white flower equals 5 (NAWF=5). At this point, the COTMAN user begins input of daily temperature data used by the program to calculate heat unit (DD60) accumulations. This information is used to time crop protection inputs as well as defoliation activities. For example, after 350 DD60s have been accumulated following the cutout date, the last effective boll population is no longer susceptible to damage from cotton bollworm, tobacco budworm, tarnished plant bug, and boll weevil (Fig. 2). There is research evidence that terminating insect application at 350 heat units after NAWF=5 may have a small yield advantage (Oosterhuis *et al.*, 2000).

SPECIFIC USES FOR COTMAN IN RESEARCH

The COTMAN growth curve can be used to describe the time of inputs in research plots by providing a reference point that is easliy communicated. For example, the description of the application time for a fertilizer or plant growth regulator would be referenced to number of squaring nodes (either pre-flower or post flower) in addition to other descriptors such as calendar date. The date, *September 2,* will mean something entirely different to workers in Australia, California, and Alabama, but with the use of COTMAN, communication is enhanced with the addtional information—*application was made September 2, at NAWF = 5 plus 100 DD60s.*

Communication is further enhanced if COTMAN growth curves from the experiment are included in the description of crop development. The following examples of growth curves from actual replicated small plot experiments are provided to demonstrate how efficiently COTMAN output can provide a composite picture of crop stress. These experiments were conducted on the Cotton Branch Experiment Station in Marianna (Teague *et al.*, 1999; Oosterhuis *et al.*, 1999), on Wildy Farms near Manila, and at the USDA-ARS Stress Physiology Laboratory in Lubbock, TX. COTMAN was used to monitor research plots weekly from early squaring until cutout. Changes in crop development resulting from experimental treatments were monitored as changes in squaring nodes and compared to the COTMAN Target Development Curve (Figs. 2-5).

LABOR REQUIREMENTS

In 1998 research at the University of Arkansas Cotton Branch Station in Marianna, a two-person mapping team took approximately 12 min per plot to collect COTMAN data. Few special skills were needed for mappers outside those typically required for part-time summer student research assistants. COTMAN training is generally completed in 1 day. High school and undergraduate students typically have been employed as mappers.

PRACTICAL APPLICATION

COTMAN as a research tool to monitor for crop stress can aid in data collection, analysis, and communication of results. The process is practical and efficient, and labor requirements are not excessive.

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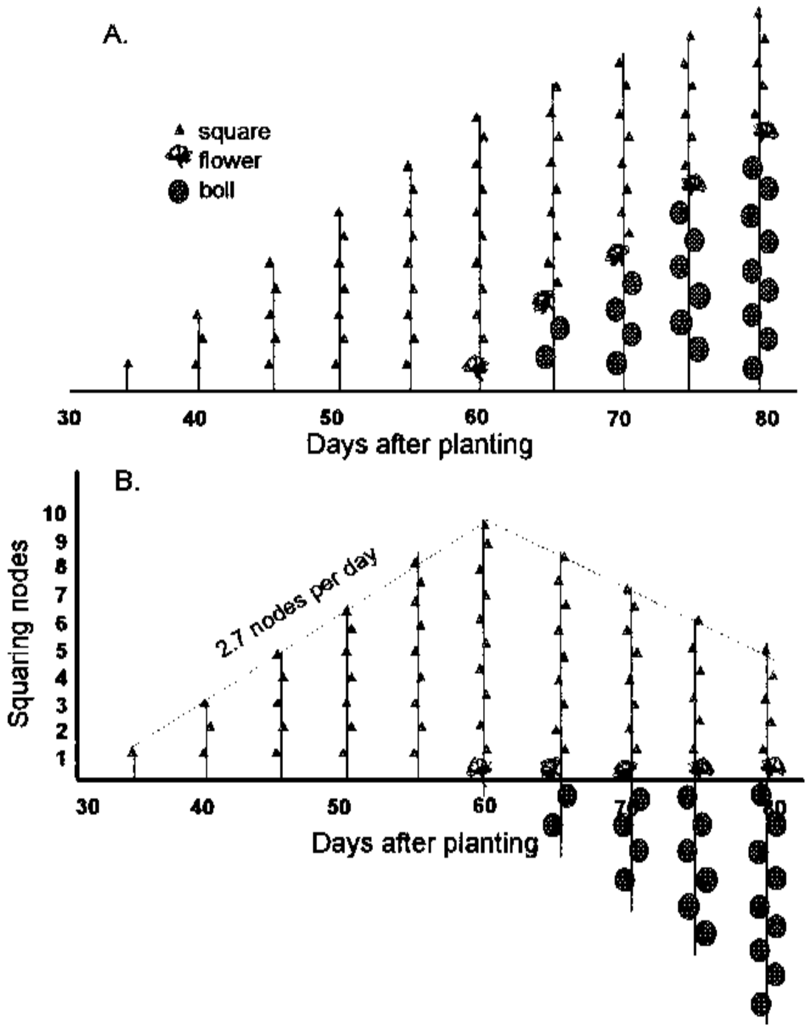

Figure 1. Main-stem nodal development of cotton is simple to monitor by tracking the number of fruiting branches that have not yet flowered (A). When these squaring nodes are plotted against days there is an abrupt downturn at first flower associated with good stress from boll loading (B). The resulting curve is the basis of the COTMAN Target Development Curve.

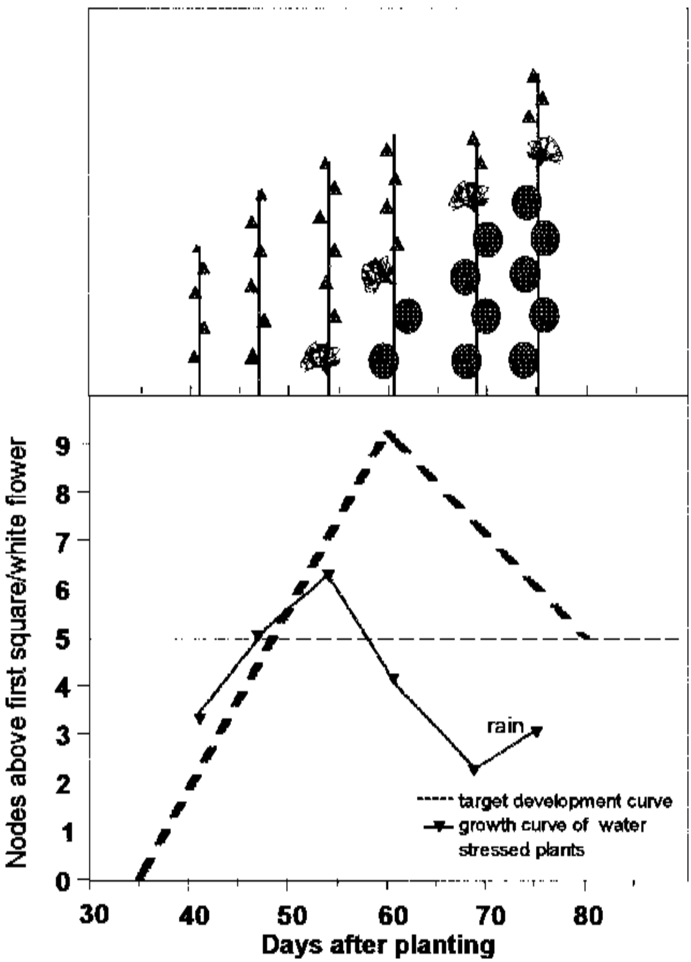

Figure 2. Water stress resulted in reduced squaring node development and pre-mature cutout in the non-irrigated treatment plots in a 1998 irrigation study in Marianna. The average plant from that treatment is depicted as stick figures (above); plant data are presented as a COTMAN growth curve (below) that can be compared to the COTMAN crop development curve (Teague *et al.*, 1999).

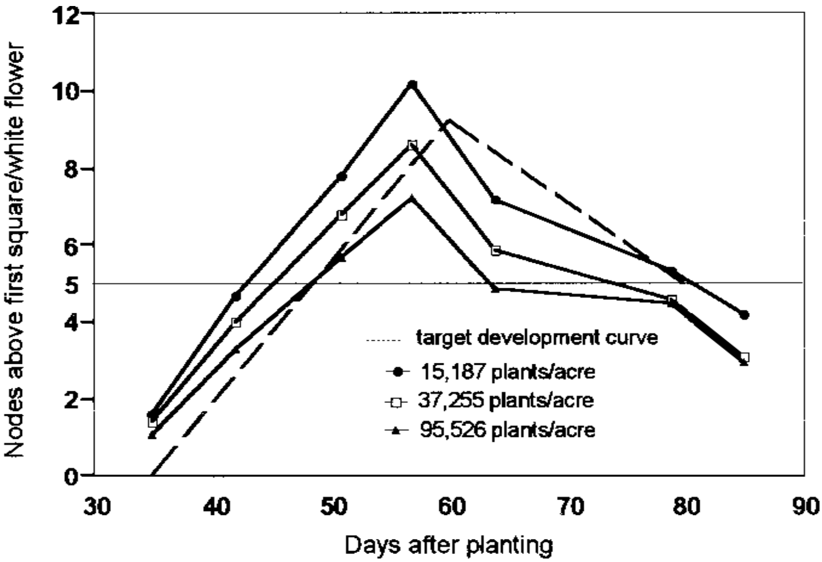

Figure 3. Effects of increased plant to plant competition resulting from increased numbers of plants per acre is evident when comparing these three COTMAN crop growth curves from a 1998 replicated field experiment in Marianna (Oosterhuis *et al.*, 1998).

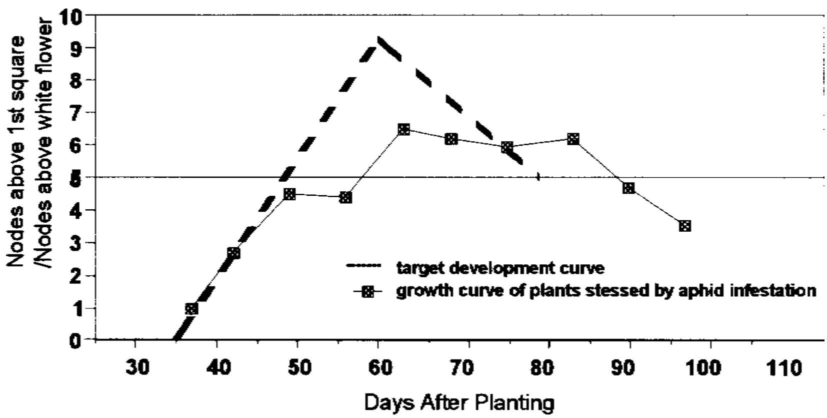

Figure 4. Stress resulting from a infestation of cotton aphid is evident 50 to 57 days after planting in this COTMAN growth curve recorded in a commercial field near Manila in 1999 (Teague *et al.*, 1999).